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Tackling the Sustainability Iceberg: A Transaction Cost Economics Approach to Lower Tier Sustainability Management

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Abstract

Purpose – This article investigates how buying firms manage their lower tier sustainability management (LTSM) in their supply networks and what contextual factors influence the choice of approaches. As most of the environmental and social burden is caused in lower tiers we use the iceberg analogy.

Design/methodology/approach – Findings from 12 case studies and 53 interviews, publicly available and internal firm data are presented. In an abductive research approach, Transaction Cost Economics (TCE) conceptually guides the analytical iteration processes between theory and data.

Findings – This study provides eight LTSM approaches grouped into three categories: direct (holistic, product-, region-, and event-specific) indirect (multiplier-, alliance-, and compliance-based) and neglect (tier-1-based). Focal firms choose between these approaches depending on the strength of observed contextual factors (stakeholder salience, structural supply network complexity, product and industry salience, past supply network incidents, socio-economic and cultural distance and lower tier supplier dependency), leading to perceived sustainability risk (PSR).

Research limitations/implications – By depicting TCE's theoretical boundaries in predicting LTSM governance modes, the theory is elevated to the supply network level of analysis. Future research should investigate LTSM at the purchasing category level of analysis to compare and contrast PSR profiles for different purchase tasks and to validate and extend the framework.

Practical implications – This study serves as a blueprint for the development of firms' LTSM capabilities that suit their unique PSR profiles. It offers knowledge regarding what factors influence these profiles and presents a model that links the effectiveness of different LTSM approaches to resource intensity.

Originality/value – This study extends the application of TCE and adds empirically to the literature on multi-tier and sustainable supply chain management.

Keywords Case studies, lower tier sustainability management, multi-tier supply chains, sustainability risk, sub-suppliers, Transaction Cost Economics

1. Introduction ♣

Buying firms are often held responsible for sustainability-related misconduct in their supply network by various stakeholders (Hofmann *et al.*, 2014). This "chain liability effect" (van Tulder *et al.*, 2009) places focal firms in danger of suffering reputational damage and financial loss from misconduct that occurs beyond their direct control (Seuring and Müller, 2008). Consequently, many buying firms have adopted strategies and practices to ensure sustainable business conduct of their suppliers (Wilhelm *et al.*, 2016a).

Yet, the current emphasis of sustainable supply chain management (SSCM) is mainly centered on direct suppliers (Pagell *et al.*, 2010), which may blind buying firms to those critical lower tier suppliers, or nexus suppliers, that can play important roles within supply networks (Yan *et al.*, 2015). A major portion of the social and environmental burden occurs at suppliers located further upstream in the supply chain during a product's manufacturing process (Tate *et al.*, 2014). Therefore, we construct the analogy to an iceberg, whose greatest threat remains invisible when regarded from seemingly safe distance. Recent incidents suggest that common practices targeting the improvement of close and visible first-tier suppliers are of minimal use in preventing unsustainable behavior of lower tier suppliers (Rauer and Kaufmann, 2015). Although the Italian chocolate and confectionery producer Ferrero had banned child labor in its code of conduct and although its suppliers had been independently audited, Ferrero was severely accused of exploitation and child labor at a sub-contractor in Romania (Parker, 2016). In response to these negative examples, many firms have decided to dig deeper into their upstream supply networks and to conduct lower tier sustainability management (LTSM).

Prior research on SSCM has acknowledged the importance of extending practices beyond first-tier suppliers (Tachizawa and Wong, 2014; Wilhelm *et al.*, 2016a; b). However, extant research highlights that it is costly and nearly impossible for buying firms to manage thousands of lower tier suppliers with respect to their sustainability performance (Rauer and Kaufmann, 2015).

Surprisingly, knowledge on why some firms apply LTSM while others do not is still lacking and prior research has not sufficiently addressed which specific approaches to LTSM are suitable for the various business and relational contexts that buying firms face in their

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lower tier supplier environment (exemptions are e.g., Grimm *et al.*, 2016 and Wilhelm *et al.*, 2016b). Thus, this study seeks to develop testable propositions in answering the following research questions: (1) How do buying firms manage their lower tier suppliers for sustainability? (2) What contextual factors influence these firms' choice of one LTSM approach over another?

In accordance with the suggestion for more qualitative, theory development approaches in SSCM (e.g., Carter and Easton, 2011), we conduct abductive multiple case studies to answer these questions. To enhance the explanatory power and to support the dialogue between research and practice (Pagell and Shevchenko, 2014), we embed our findings in Transaction Cost Economics (TCE) (Ketokivi and Choi, 2014). In addition, this study responds to the call for a wider application of TCE (Sarkis *et al.*, 2011) by challenging the theory through a revelation of its boundaries when applied to LTSM.

The study's contributions are threefold. First, this paper is among the first that advances theory development in LTSM by presenting different LTSM categories and approaches. Thereby, we complement extant research on LTSM recognizing the importance of the diffusion of imitable practices as an alternative to self-centered proprietary efforts (Carter *et al.*, 2017), especially when it comes down to handling lower tier suppliers characterized by weak ties through so-called arm's-length collaboration (Kim and Choi, 2015). Second, the growing field of risk management in SSCM research (cp. Busse *et al.*, 2017b) is augmented as our results suggest that the perceived sustainability risk (PSR) of buying firms influences their choice of LTSM approaches. Third, we enhance managerial decision making by providing SCM and procurement professionals with insights regarding their firm's individual PSR profiles and by offering a practical model linking LTSM approaches to resource intensity.

In summary, our findings support buying firms in building trust into the sustainability practices across numerous globally dispersed suppliers without engaging in the cost-prohibitive and ineffective distant monitoring of such complex networks.

The remainder of this paper is structured as follows. The next section describes the study's conceptual background. Thereafter, the methodological approach and the data are presented. Subsequently, in the fourth section the results of the case analyses are shown. Finally, this paper concludes with a discussion of theoretical and practical implications, an acknowledgement of limitations and suggestions for future research.

2. Theoretical background

2.1 Lower tier sustainability management

A substantial amount of research has been conducted on SSCM, as is evident in the number of literature reviews that have appeared on the topic (e.g., Touboulic and Walker, 2015). However, these studies are largely focusing on direct suppliers (Rauer and Kaufmann, 2015). Thus, the knowledge of SSCM approaches in lower tiers of supply networks is mainly lacking, except for a few recent exemptions (e.g., Dou *et al.*, 2017; Grimm *et al.*, 2016; Mena *et al.*, 2013; Tachizawa and Wong, 2014; Wilhelm *et al.*, 2016b). This research gap is particularly interesting because the greater part of a supply network's environmental and social burden occurs at supplier sites distant from the buying firm (Grimm *et al.*, 2014). In addition, regulations, such as REACH, require firms to obtain sustainability-related information from their lower tier suppliers and to manage them (Meinlschmidt *et al.*, 2016). Therefore, from a risk and compliance perspective, buying firms should consider extending their sustainability strategies and practices to distant tiers further upstream in their supply network (Wilhelm *et al.*, 2016a).

Previous studies have shown that focal firms pursue different sustainability approaches, often varying in their intensity (e.g., Grimm *et al.*, 2016). While some buying firms interact only with their direct suppliers which act as gatekeepers and help them to approach suppliers at distant tiers (Wilhelm *et al.*, 2016a), other firms approach lower tier suppliers directly to control and monitor their sustainability performance (e.g., Grimm *et al.*, 2016). However, the missing direct business relationship with second- or third-tier suppliers and the resulting opaque supply network structures often cause information deficits for buyers (Busse *et al.*, 2017a). Wilhelm *et al.* (2016b) investigated multi-tier supply chains in different industries with respect to LTSM strategies and their particular contingencies. Their research contextualizes the handling of lower tier suppliers characterized by weak ties through so called-arm's length collaboration (Kim and Choi, 2015). In addition, Mena *et al.* (2013) found that institutional distance, horizontal complexity, sustainability capabilities of the direct supplier and the topical sustainability focus play important roles in supplier management. Grimm *et al.* (2016) mainly find public attention on the mediating first-tier supplier to drive the perceived risk of sub-suppliers' non-compliance. Moreover, a focal buying firm's channel power influences its engagement in sub-supplier management. Only recently – however focusing on environmental aspects of sub-supplier management – Dou *et al.* (2017) emphasize top managers' support and geographic proximity of supply chain members as important enablers. Still, deep-level insights on the numerous LTSM approaches available to

buying firms and their contextual applications are missing today.

Since focal buying firms are often only responsible for a small percentage of indirect turnovers of lower tier suppliers, they have only limited power to apply captive sourcing governance modes and cannot compensate for the lack of direct control through incentives, as suggested by TCE (Plambeck *et al.*, 2012). When focal buying firms seek to apply a network-spanning approach, the opaque network structure requires them to devote more resources to identification and auditing mechanisms. Only then, critical lower tier suppliers with poor sustainability practices can be either eliminated or supported (Pagell *et al.*, 2010). Therefore, decision makers must balance the associated transaction costs in terms of information gathering and supplier-auditing capacity (Zsidisin and Siferd, 2001) with the benefits they obtain from applying LTSM (Busse *et al.*, 2017a). Such benefits may include higher selling prices, risk reduction or winning orders over competitors (Foerstl *et al.*, 2015). TCE considers these potential costs, such as reputational damage (e.g., caused by a potential supplier scandal) or gaining extra margins (e.g., through distinct sustainability features) as opportunity costs. Accordingly, firms will apply LTSM as long as these expected negative opportunity costs prevail the costs for LTSM.

2.2. Transaction Cost Economics

TCE argues that a firm's make-or-buy decision is determined not only by the price of the purchased item but also its transaction costs (Williamson, 1973). These transaction costs can occur ex-ante or ex-post the transaction (Williamson, 2008). Ex-ante costs are typically related to information-seeking processes and the negotiation of contractual terms, whereas ex-post costs primarily stem from monitoring tasks and other processes that target the enforcement of contractual agreements (Rindfleisch and Heide, 1997). Accordingly, the adequate governance mode for a transaction (i.e., market, hybrid and hierarchy) is the one which results in the lowest total costs (Williamson, 1973).

TCE rests on key assumptions of human behavior (i.e., bounded rationality and opportunism) and two main dimensions of transactions (i.e., asset specificity and uncertainty) (Rindfleisch and Heide, 1997; Williamson, 1985). Bounded rationality refers to the undoubted fact that decision makers' cognitive capabilities and rationality are constrained (Rindfleisch and Heide, 1997). Opportunism refers to exchanging actors that have a tendency toward self-seeking interest with guile (Williamson, 1985).

Consequently, "attenuating the ex post hazards of opportunism through the ex-ante choice of governance is central to the transaction cost economics exercise" (Williamson 1998, p. 31). Opportunism is particularly problematic when the buyer has no transparency over its

upstream supply network. The buyer then faces a safeguarding problem and becomes exploitable. Configurations of opportunism together with bounded rationality and the following key dimensions of transactions result in different governance modes, which aim at attenuating such negative effects (Grover and Malhotra, 2003). For instance, in situations in which asset specificity is based on idiosyncratic investments, opportunism becomes an important threat. Thus, low degrees of asset specificity should be governed through the market, high degrees through hierarchies and medium degrees by hybrid governance modes (Williams, 1998). Similar to asset specificity, the configurations and interactions of environmental uncertainty (i.e., uncertain environments "in which the circumstances surrounding an exchange cannot be specified ex ante" (Rindfleisch and Heide, 1997, p. 31)) and behavioral uncertainty (i.e., uncertain environments in which "performance cannot be easily verified ex post" (Rindfleisch and Heide, 1997, p. 31)) require different LTSM governance modes.

Initially, TCE has been widely used to explain sourcing phenomena (Grover and Malhotra, 2003) and has also been applied to SSCM research more recently (e.g., Delmas and Montiel, 2009). For instance, Simpson *et al.* (2007) find that asset specificity moderates between a supplier's sustainability commitment and customer pressure for sustainability. Other studies found that suppliers are more likely to engage in sustainable business practices when information-seeking costs are low (Tate *et al.*, 2014). However, research continues to call for more TCE application in future studies (Sarkis *et al.*, 2011).

Unlike to what TCE proposes, a contractual relation between the focal firm and lower tier suppliers is not necessarily given. Therefore, TCE's initial scope of application is surpassed in this study. However, the underlying hypothesis of applying TCE in our research context is that – given certain configurations – focal firms are inclined to apply LTSM. Otherwise, they would potentially suffer from opportunity costs linked to reputational damage, loss of orders, or foregone revenues. Clearly, devoting resources to LTSM is associated with transaction costs in terms of identifying (ex ante) and monitoring (ex post) critical lower tier suppliers. The TCE perspective enables us to theorize the opportunities and risk reduction potential of specific LTSM approaches in conjunction with the costs of implementing them, thereby generating relevant managerial insights (Williamson, 1998).

3. Methodology

3.1 Research design

An abductive, multiple case study approach is applied for four reasons. First, prior research has encouraged case studies over surveys as the method of choice in SSCM (Carter and

Rogers, 2008). Second, there is a limited understanding of how and when firms apply LTSM. This requires exploratory theory development to substantiate the constructs and propositions (Eisenhardt, 1989). Third, utilizing multiple data sources and asking clarification questions contributes to higher internal and construct validity through triangulation (Yin, 2003) and helps mitigating the social desirability bias (Carter and Easton, 2011). Fourth, due to the participation of managers operating in real LTSM situations, we are able to develop and elaborate a theory of high relevance to practitioners (Gibbert *et al.*, 2008).

We applied an abductive theory elaboration approach that "involves modifying the logic of the general theory in order to reconcile it with contextual idiosyncrasies" (Ketokivi and Choi, 2014, p. 236). Accordingly, TCE exists as a potent lens to guide our exploration, in which the research context also plays a significant role in the theorizing process (choice of LTSM governance mode). Moreover, abductive theory elaboration is the most appropriate method when a priori hypotheses cannot be deduced; as in our case in which contextual factors and LTSM approaches were not previously known. Throughout the research process, the theoretical perspective augments the understanding of the contextually derived data ex post (Ketokivi and Choi, 2014).

3.2 Sampling

With the initial sampling of six industries, we sought to purposefully maximize the data richness by gaining comprehensive insights from the most interesting cases. To do so, we focus on large internationally operating focal firms that are likely to apply LTSM (Bowen, 2002). To further enhance the generalizability of our results, industries were selected that are typically exposed to sustainability challenges: chemicals (*Chem*), pharmaceuticals (*Pharma*), furniture (*Furn*), apparel (*Appa*), packaging (*Pack*) and semi-conductors (*Semi*).

Whereas firms in the chemical and pharmaceutical industries source a high percentage of raw materials that are harmful to humans and the natural environment (Christmann, 2000), firms that produce furniture (Handfield *et al.*, 1997) and clothing (Yu, 2008) are commonly criticized for their suppliers' pollution of the environment and inhumane labor practices. In the packaging industry, firms sell their products to a broad range of buyers from different industries and thus must comply with various sustainability demands (Foerstl *et al.*, 2015). Moreover, firms that produce semi-conductors face high stakeholder pressure to responsibly source raw material to guarantee conflict free mineral supply chains (Hofmann *et al.*, 2015).

Out of 25 contacted international firms we managed to solicit the cooperation of twelve buying firms, two firms from each of these six industries. The sample involves a sustainability leader and a follower from the six industries mentioned above (Table 1).

Sustainability leaders were identified based on the firms' listings in sustainability indexes and their mentioned sustainability engagement in the media.

Overall, this sampling approach ensured variance in the dependent and the independent variables within and across industries and was assumed to enable the detection of different LTSM approaches (Tachizawa and Wong, 2014).

The final sample includes 53 interviews at twelve firms. Additional interviews outside the scope of the here presented cases were conducted. However, it was concluded that theoretical saturation (Yin, 2003) was achieved as these cases did not reveal new LTSM approaches or drivers.

---------- Insert Table 1 approximately here ----------

3.3 Data collection

As LTSM is cross-functional, informants from the purchasing, quality and sustainability department were interviewed in each case. Whenever possible, interviews were jointly conducted by two researchers, based on a semi-structured guideline. According to our abductive research approach, we used sustainability reports and supplier codes of conduct for the preparation of interviews and to inquire how certain practices are being conducted. The interviews lasted between 45-150 minutes and were transcribed based on recordings and interviewer notes. For triangulation purposed and to ensure reliability and content validity, additional documents, such as procurement guidelines, supplier evaluation sheets and publicly available sustainability reports were critically analyzed (Eisenhardt, 1989).

To ensure that new and interesting facets were included in subsequent interviews, we adjusted the guideline as necessary (Yin, 2003). Furthermore, we shared the transcripts with the informants to verify the accuracy of facts and to ensure reliability (Ellram, 1996). Additionally, a case database that incorporates the individual notes, the interview transcripts, the content from firm websites, the observation sheets and all the internal and publicly available data was established (Yin, 2003).

3.4 Coding

The analysis began with an open coding of the interview transcripts to develop a thorough understanding of each case's unique pattern (Strauss and Corbin, 1990). Thereafter, the data were triangulated with internal purchasing and auditing guidelines to check for consistency of statements provided by our informants. Based on this, first-order codes of LTSM approaches and their intensity as applied at each firm were extracted in a within-case analysis (Pratt,

2009). For brevity reasons, we only present the cross-case findings in the development of our research proposition (section 4). The profile of each firm in terms of contextual factors and LTSM approaches can be obtained from Table 4 and 5.

In a next step, axial coding was applied to detect commonalities and differences in LTSM approaches across cases (Ellram, 1996; Pratt, 2009), which also led to the distinction in proactive, active and reactive LTSM approaches (Figure 1, end of section 4). To manifest and complement these relative comparisons, we applied pattern-matching to identify contextual factors that explain each firm's PSR and choice of LTSM approaches (Yin, 2003). To theorize our findings, we then reflected the case findings in TCE in order to derive more abstract second-order quotes. Accordingly, we structured our findings along the transaction cost drivers and the resulting governance modes (Figure 1). This process was non-linear but required numerous iterations between data coding and theory elaboration. Thus, the analysis revealed the abductive reasoning at a more general level and supported us in developing theoretical perspectives on LTSM (Strauss and Corbin, 1990).

4. Results

In 4.1, we present eight LTSM approaches that emerged during data analysis. These were clustered into three overarching categories according to their resource intensity (Table 2). In 4.2, we identify six contextual factors that drive a focal firm's PSR and which are clustered according to the TCE dimensions. Finally, we provide insights into how firms chose between the available approaches (4.3).

4.1 LTSM approaches and categories

The LTSM approaches are presented according to their categories (i.e., direct, indirect, neglect); ordered from high to low resource intensity in line with their proactive, active or reactive nature (Figure 1). Prior research found that the most resource-intensive approaches have also proven to be the most effective in reducing lower tier sustainability risks and in enhancing the sustainable product characteristics of the buying firm, thus justifying their application in a given context (Williamson, 2008).

---------- Insert Table 2 approximately here ----------

4.1.1 Direct LTSM approaches

In the category of direct LTSM approaches, buying firms directly evaluate, select and develop lower tier suppliers using their own resources. Among our sample, four associated approaches belonging to the direct category were identified (Table 2).

The *holistic approach* is characterized by the highest resource allocation, since buying firms manage their lower tier suppliers regularly. In the case sample, only *Appa1* pursued this approach. This apparel firm uses a highly forward-thinking, proactive sustainability strategy, including an environmental profit and loss accounting method that assesses the environmental burden caused throughout its entire upstream supply chain. Therefore, *Appa1* seeks environmental information from its entire supply network and its evaluation includes third-tier suppliers (dye houses and tanneries) on a monthly basis (selects and retains them based on the evaluation results and develops them if necessary) as mentioned by its Chief Sourcing Officer: "We assessed the environmental and social performance of all our direct and indirect suppliers once up to tier-n, which is tier four in our case. We evaluate and develop our tier-2 and tier-3 suppliers on a regular basis and even indicate to our direct and tier-1 suppliers where to source from" (Table 2). The cotton field and cattle farm suppliers on the fourth tier were only assessed once to complete *Appa1's* picture of the environmental burden within its supply chain. However, the firm plans to directly manage these fourth suppliers soon. This approach requires the highest resource intensity, yet it also provides firms the greatest likelihood of being able to identify and rectify sustainability misconduct in their upstream supply chains. Therefore, the holistic approach is effective in exerting control over and coordinating the supply chain for sustainability in a proactive manner.

The *product-specific* and the *region-specific* approaches to direct LTSM were found to be similar in their logic as buying firms evaluate and develop certain suppliers depending on the products they deliver or their locations. The product-specific approach was identified in *Chem1*, *Pharma1* and *Furn1*. Executives of these firms noted that they do not intend to manage all their lower tier suppliers regularly. Instead, the executives do so for specific products that are considered critical in their peer industries, as confirmed *by Chem1*: "Normally we just control our tier-1 suppliers, but regarding critical products, such as palm-oil, we control up to tier-n" (*Ch1C*). Similarly, *Pharma1* controls lower tier suppliers that deliver certain active pharmaceutical ingredients made under potentially environmentally harmful conditions, whereas *Furn1* ensures that coated steel from lower tier suppliers does not contain toxic lubricants (Table 2). Similarly, the region-specific approach is selectively applied to suppliers that are based in regions in which environmental misconduct and labor standards violations are assumed: "In specific regions, such as Asia, we audit certain second-tier suppliers when we suspect non-compliance with labor standards" (*Ph1C*). In addition to Asian lower tier suppliers, *Chem1* also applies this approach, if suppliers are located in South America. Due to their selective application to lower tier suppliers, the product- and region-

specific approaches are often applied in combination (*Chem1* and *Pharma1)*. The use of these approaches requires fewer resources than the previously noted holistic approach. As it is recurrently applied by our cases it is considered an active approach. However, across cases we find that these approaches are less effective in identifying and rectifying sustainability misconduct at lower tier suppliers compared to the holistic approach, which is also consistent with recent findings (Busse *et al.*, 2017).

The last approach in the category of direct LTSM is the *event-specific* approach is considered a reactive measure. The approach enables firms to apply LTSM by utilizing their own resources when facing certain critical and urgent events, such as the detected or suspected non-compliance of a lower tier supplier, as was observed at *Pharma2*: "We were informed by an NGO that children collect raw materials in fields at an Indian lower tier supplier. We had to implement supplier development programs and to modify our supply chain to solve this problem" (*Ph2C*). At *Furn1*, LTSM activities were identified as a consequence of a major customer order that required detailed information regarding the product's and upstream supply chain's environmental characteristics (Table 2). In applying this approach, focal firms do not proactively engage in identifying critical lower tier suppliers. Instead, the firms only conduct audits and rectify misconduct at second- or third-tiers that have been identified as or suspected to be critical. Therefore, the required resource investment is the lowest among the four identified direct approaches. However, this approach is also the least effective in continuously and proactively preventing misconduct in this category.

4.1.2 Indirect LTSM approaches

Indirect LTSM approaches are characterized by indirectly evaluating, selecting and developing lower tier suppliers through relational and cooperative governance modes. This category of LTSM approach can be considered a hybrid (Williamson, 2008), since firms manage lower tier suppliers with own and foreign resources.

The *multiplier-based* approach is characterized by focal firms managing their direct suppliers in special projects for sustainability. In turn, these suppliers commit themselves to manage their own suppliers based on equally strict standards in a proactive manner. This approach was observed at *Chem1*, as stated in its sustainability report: "We form a team of three suppliers, with the aim of promoting CSR and giving guidance in the form of best practices and customized solutions along our supply chain. Each of the three partners then introduces the same concept to three further business partners in its own supply chain." This approach is highly efficient and entails advantages for both parties. The direct supplier receives knowledge and shares its sustainability capability beyond the ordinary scope of

commitment with distant tiers (Table 2). By applying this approach, the buying firm creates a "multiplier effect" throughout its supply network and ensures compliance with its supplier code of conduct among lower tier suppliers. Therefore, the resource dedication is considered low compared to its effectiveness in reducing sustainability-related risks and leveraging sustainable product characteristics.

An *alliance-based* approach was also found to enable indirect LTSM. This approach includes mechanisms in which buying firms participate in sustainability-related alliances and industry consortia (e.g., Together for Sustainability and Pharmaceutical Supply Chain Initiative). Nearly all companies are active members of at least one such alliance and consortia or co-founded them. Such memberships enable firms to indirectly ensure sustainability standards at lower tier suppliers as several of these alliances use independent service providers to control compliance at sites, while others enable firms to exchange audit information obtained from lower tier suppliers on a recurring basis (Table 2). The required resource allocation in this active approach is lower than in the multiplier-based approach as the former does not necessarily require the buying firm to engage in direct supplier development activities. The approach's effectiveness is comparatively high since lower tier supplier compliance is achieved through independent audits according to a widespread industry standard. However, this LTSM approach requires prior identification of critical lower tier suppliers. In this context, firms applying indirect LTSM approaches have entire departments dedicated to stakeholder and sustainability-alliance interaction.

Last, a *compliance-based* approach was observed. Often, in their supplier codes of conduct, focal firms demand that direct suppliers apply the same sustainability requirements to their own suppliers (Schleper and Busse, 2013). Except for *Furn2*, all cases apply this approach, as stated in *Pack2's* supplier code of conduct: "We encourage our suppliers to procure raw materials and services in an ethical manner that supports sustainable business practices." Nearly all firms included such a passage; however, they admitted that they do not actively control whether their direct suppliers manage all their suppliers for sustainability, but use them as reactive assurance against acusations (Table 2). Therefore, such compliance-based instruments have not yielded the expected effects in improving sustainability (Lund-Thomsen and Lindgreen, 2014). Instead, without enforcement and engagement in substantial action, this approach must be considered a symbolic act; this is often also regarded as "greenwashing" (Blome *et al.*, 2017).

4.1.3 The neglect approach

Furn2 is the sole firm that does not engage in LTSM. Given that the firm does not engage in interaction beyond tier-one suppliers, it solely relies on market-based governance according to TCE (Williamson, 2008).

4.2 Perceived sustainability risk

Sustainability risks are an important sub-topic in SSCM research (e.g., Foerstl *et al.*, 2010; Hofmann *et al.*, 2014). How much risk an organization perceives is a matter of a firm's individual characteristics as it faces external uncertainty with imperfect knowledge regarding the probability and severity of risks (Mitchell, 1995). Accordingly, the level of PSR is subjective and differs from firm to firm. In accordance with the prior research (e.g., Busse *et al.*, 2017b), in this study, we refer to the "perceived sustainability risk" as an individual buying firm's perception of how likely it is that (i) a negative sustainability-related condition or event occurs within the supply network, (ii) stakeholders take note of this condition or event, (iii) stakeholders ascribe responsibility to the buying firm for being capable of preventing such negative incidents or conditions and (iv) stakeholders subsequently determine to punish the buying firm.

During the interviews, PSR emerged as the pivotal concept and the driver of why LTSM is pursued at all (see Table 3). Due to the introductory, prominent negative examples in which sustainability risk was manifested and focal buying firms suffered from adverse stakeholder reactions, a high sensitivity to sustainability-related risks exists, as demonstrated by *Chem1*, which remarked that "the big challenge that we face is that we cannot control all practices and provided data; there are just too many sub-suppliers that we would need to process, but we have to get started to reduce our exposure to those risks" (*Ch1C*). This is in line with prior research that emphasized the influence of sustainability risks on sub-supplier management practiced (e.g., Grimm *et al.*, 2016). Subsequently, we present the factors that determine a focal firm's PSR and, thus, their choice of LTSM approaches and mechanisms (Figure 1)

---------- Insert Table 3 approximately here ----------

4.3 Contextual factors

Six contextual variables that drive a focal firm's PSR and, in turn, increase the need to LTSM were identified (Table 4). According to the theoretical framework, these underlying

contextual factors are clustered along the three dimensions of TCE: environmental uncertainty, behavioral uncertainty and asset specificity.

---------- Insert Table 4 approximately here ----------

4.3.1 Environmental uncertainty

Throughout the interviews, stakeholder salience was identified as a crucial factor for uncertainty in a focal firm's environment. Several firms affirmed that they are driven by these stakeholders in pursuing LTSM (Table 3 & 4). Particularly consumers and customers represent powerful stakeholder groups because they pose the risk of boycotts, reputational damage and a subsequent loss of sales (Busse *et al.*, 2017b). *Semi1* explained: "Our customers from the consumer electronics industry push us to implement sustainable procurement practices even with our sub-suppliers" (*Se$_{1D}$*). In addition to customers and consumers, NGOs, unions and the media often pressure buying firms to apply LTSM, as the introductory example of child labor has shown. Although these stakeholders are not in any contractual relationship to the buying firm, they are powerful actors that advocate on behalf of weaker stakeholders such as exploited children who are deprived of their legitimate and urgent claims. Among the firms studied, the most pressing example occurred at *Pharma2*, which was informed by an NGO that children were working at one of its lower tier suppliers. *Pharma2* immediately reacted to this urgent claim by applying direct development activities to this sub-supplier to rectify this severe misconduct.

Prior research has emphasized the influence of stakeholder pressure on the adoption of SSCM practices by firms as an important aspect (e.g., Parmigiani *et al.*, 2011). In accordance with Mitchell *et al.*'s (1997) theory of stakeholder salience, which transcends mere stakeholder pressure, three different attributes influence how salient stakeholders are perceived by managers: their power, the legitimacy of their claims and the urgency associated with these claims (Table 4). Thus, together the case examples reveal the influence of 'stakeholder chains' on focal buying firms' PSR (Busse *et al.*, 2017b) in a way that the larger the number of Mitchell *et al.*'s (1997) three characteristics is combined in a stakeholder, the higher its salience for our case firms. Therefore, the following is proposed:

> P1: The higher the stakeholder salience in terms of power, legitimacy and urgency, the higher the buying firm's PSR.

A focal firm's structural supply network complexity emerged from the data as the second contextual variable. Whereas the vertical and horizontal complexity are influenced by

the number of upstream tiers and the suppliers at the same tier level, the spatial complexity refers to the dispersion of tiers among different countries and locations (Table 4). In accordance with prior research, the term is defined as the overall degree of the vertical, horizontal and spatial complexity (Choi and Hong, 2002).

In our sample, firms from the chemical, pharmacy and apparel industries exhibit a high structural supply network complexity of a maximum of four tiers. The managers at these firms acknowledged a high PSR as sustainability-related uncertainty arises from a large number of lower tier suppliers (Table 4). This higher complexity results in less visibility and higher uncertainty regarding lower tier supplier's sustainability conduct as expressed by one interviewee: "We have a verification problem in our supply network if we want to evaluate beyond first-tier suppliers that requires effort to generate transparency of second-tier suppliers and beyond (W_{1B})." Firms from the furniture, packaging and electronic industries indicated less need to apply LTSM. These firms are located further upstream, they must only apply LTSM at a two tier levels, in contrast to *Furn1* and *Furn2*, which are major buying firms.

This finding is in line with recent research that found that the higher the structural supply chain complexity is, the higher the probability that buying firms lack sufficient knowledge of their lower tier suppliers (Busse *et al.*, 2017b; Carter *et al.*, 2015; Grimm *et al.*, 2016). Horizontal complexity in particular is a main contingency for the LTSM strategy of focal buying firms (Wilhelm *et al.*, 2016b). Therefore, the following is proposed:

> P2: The higher a buying firm's structural supply network complexity is, the higher its PSR.

Given the environmental uncertainty, a product's and an industry's salience to end customers is conjectured to also influence a focal buying firm's PSR. Among our cases, the products of *Pharma1*, *Pharma2*, *Furn1*, *Furn2*, *Appa1* and *Appa2* are directly sold to end customers and thus highly visible in the marketplace. Executives stated that their firms feel pressured from NGOs and end consumers to apply LTSM. *Chem1*, *Chem2*, *Pack1*, *Pack2*, *Semi1* and *Semi2* sell their products exclusively in business-to-business contexts, therefore perceiving less pressure (Table 4). However, *Chem1* (which is listed in the German stock index DAX 30) and *Pack1* (which promotes its products prominently on television) indicated higher pressure for sustainable conduct in their respective supply networks: "We must have a clear view of what is going on at the second- and third-tier suppliers and that is why we seek to increase transparency through sub-supplier audits" (Se_{1C}).

Previous research suggests that firms selling highly visible products to the public must place greater emphasis on SSCM (Schneider and Wallenburg, 2012). Furthermore, Hajmohammad and Vachon (2016) emphasize that PSR is entangled with the visibility of the focal firm's industry and its position in the market. The prior research has found that firms that lack publicly known brand names wait longer to apply SSCM (Simpson *et al.*, 2012) as they feel less pressured to do so (Foerstl *et al.*, 2015) as has been the case for *Chem2, Pack2, Semi1* and *Semi2* (Table 4). Moreover, visibility is also a function of potential harm caused to the environment in the event of sustainability failures (Mena *et al.*, 2013). Furthermore, industries in which manual, low skilled labor demand to produce the product is high are opposed to the higher risk of labor discrimination and exploitation (Simpson *et al.*, 2012).

To summarize, our data supports that critical materials and the visibility of products influence the intensity of LTSM, which is also supported by recent findings where public attention was found to be critical (Grimm *et al.*, 2016). Thus, we propose:

> P3: The higher the product and industry salience linked to the buying firm are, the higher its PSR.

4.3.2 Behavioral uncertainty

With respect to behavioral uncertainty, the occurrence of past sustainability-related incidents in the focal firm's supply base and/or its peer industry increased the PSR of the sample companies. Additionally, buying firms that experienced sustainability-related problems at its own premises or/and the premises of a competitor may have analyzed and reflected on these problems, thus creating an intensified awareness and risk perception with respect to future problems of this type (Table 3 & 4). *Pharma2* explained that perception "was informed by an NGO that children were collecting raw material in fields at an Indian sub-supplier" (B_{2D}). Based on this information, the company immediately applied its supplier development initiatives to this sub-supplier. Moreover, this incident tipped the balance for a focus on LTSM in that particular region. A similar case was reported by *Pack1*. The firm branded its products with the FSC label and when it was accused of working with a non-FSC-compliant forestry business, it immediately developed product-specific initiatives to ensure compliance across its affected supply base.

Further, the two apparel firms (*Appa1* and *Appa2*) drastically changed their buying behavior as a reaction to the preceding sustainability scandal in the supply network of their main competitor in the early 1990s. After this incident, *Appa1's* and *Appa2's* practices changed from a reactive, occasionally neglectful approach to a proactive, transparency-

seeking one. *Appa1's* Chief Sourcing Officer even explained to us that "We re-designed the supply chain in the 1990s in South East Asia in order not to face the same trouble that [one of their main competitors] had". Similar processes occurred at *Semi1* and *Semi2* when one of their main customers found itself pressured to disclose its supply chain to improve worker conditions at suppliers. In the sample, it became clear that firms that had experienced such incidents perceived a higher level of PSR and therefore engaged in more intense practices than firms that did not (*Chem2*, *Furn2*, *Pack1* and *Pack2*).

Also, extant supply chain risk management literature suggests that past experience with supplier misconduct and disruption within the own supply network and/or the supply network of a competitor is suggested to change recent risk perceptions and thus the preventive approaches for the near future (Groetsch *et al.*, 2013). Hence, we propose:

> P4: The higher the severity and frequency of past incidents in the focal firm's and/or a competitor's supply network is, the higher the focal firm's PSR.

The socio-economic and cultural distance between a buying firm and its lower tier suppliers was extracted as an additional contextual factor. At *Appa2*, it is believed that such differences drove their PSR and thus their LTSM approaches: "Major challenges for us are the cultural and regulatory differences between western European countries and emerging markets, such as China" (*Ap2A*). In addition, *B2C* indicated that "it is absolutely essential that we meet our suppliers and their sub-supplier in the region; otherwise their commitment towards us is low". Only *Furn1* and *Pack2*, whose supply bases are regionally concentrated in Western Europe, did not note this factor as part of their LTSM considerations (Table 4).

Previous research found cultural differences to be important in inter-firm relationships and global contexts with respect to supplier sustainability practices (e.g., Hofstede, 1980). Specifically in the TCE context, Luo (2007) finds that interaction with distant and different cultures is linked to higher levels of opportunistic behavior. Thus, socio-economic and cultural distant lower tier suppliers are expected to increase behavioral uncertainty as their performance is more likely to deviate from the focal firm's sustainability expectations and also more difficult to verify (Hofmann *et al.*, 2015). This finding is supported by Bhagat *et al.* (2002) who suggests that a lack of respect for cultural background may often result in challenges in the collaboration between actors. Thus, the following is proposed:

> P5: The higher the socio-economic and cultural distance between the focal firm and its major direct suppliers is, the higher its PSR.

4.3.3 Asset specificity

Related to the asset specificity TCE category, the lower tier supplier dependency was found to be an important and variable factor. For instance, whereas *Pharma1* and *Semi1* exhibit high levels of dependence on their lower tier suppliers, *Chem1*, *Chem2*, *Pharma2*, *Furn1*, *Pack1* and *Semi2* exhibit medium levels of dependence. In contrast, the remaining four firms (*Furn2*, *Appa1*, *Appa2* and *Pack2*) display low levels of lower tier supplier dependency. Across cases it was expressed that similar to dependence on direct suppliers, it is difficult if not impossible to switch to competitors in these scenarios (Table 3 and 4). The two cases from the electronics industry stressed that for example the tsunami, nuclear and social catastrophe in the Fukushima region in 2011 demonstrated the problem of important but to this point invisible lower tier suppliers that were affected by the disaster. This idea is supported by *Pharma2*: "Dropping or shifting suppliers is not an option in many cases [in this case, specialty raw materials and chemicals] due to the high market concentration" (*Ph2C*). Consequently, *Pharma2* and others, such as *Chem1*, *Pharma1* and *Semi1*, first attempt to create transparency in the supply base for these product groups and then conduct audits at the lower tier supplier levels that are most important and that one is most dependent on. Moreover, as *Appa1* launched its sustainable product line, it became more dependent on the sustainability conduct of the specific lower tier raw material and direct component suppliers (Table 4).

Prior research found different distributions of power ranging from buyer dominance over interdependencies to supplier dominance as important aspects in the context of ethical and social responsible behavior (e.g., Schleper *et al.*, 2017). When buying firms have a strong bargaining position in the supply network (i.e., less dependency), they have greater leverage in implementing and managing sustainability-related practices at lower tier suppliers and they demand propagation from the direct supplier (Andersen and Skjoett-Larsen, 2009). Buying firms that face these dependencies lack risk diversification, or back-up options and can thus be exploited by suppliers (Schleper *et al.*, 2017). Furthermore, Hajmohammad and Vachon (2016) find that buyer-sub-supplier dependence influences a buying firm's sustainability risk management perception. Thus, in line with extant literature the following is proposed:

> P6: The higher the focal firm's dependency on its lower tier suppliers, the higher its PSR.

4.4 Choice of LTSM approach

The above identified direct and indirect LTSM approaches require different levels of resource allocation and exhibit different degrees of effectiveness. The PSR of firms plays a major role

in their choice of LTSM approaches, which is driven by the contextual variables and their underlying factors (Table 4). As a result, the case companies apply a combination of (in-) direct LTSM approaches with varying (Table 5). The following section compares the firms in terms of their PSR level and applied approaches.

---------- Insert Table 5 approximately here ----------

In the sample, *Chem1*, *Pharma1* and *Appa1* encounter high PSR, as illustrated by, on average, high degrees of each individual contextual factor (Table 4). While, these firms apply indirect approaches at high levels, they additionally pursue direct LTSM approaches with high intensity, which are the most resource-intensive but also the most effective cooperative governance approaches to LTSM (Table 5). *Chem2*, *Pharma2*, *Furn1* and *Appa2* show high levels of PSR and engage in some direct, but predominantly indirect LTSM approaches, which require fewer resources but which are also less effective. *Furn2*, *Pack1* and *Semi1* experience medium levels of PSR, whereas *Pack2* and *Semi2* experience low levels. Therefore, these firms mainly chose indirect LTSM approaches, which require the fewest focal firm resources and which rely on market-based governance to provide effective sustainability at the lower tier supplier level. These findings are in accordance with the prior literature, which suggests that focal firms that face high uncertainty regarding their networks' sustainability conduct and hence have a higher PSR are more likely to vertically integrate or to apply coordinating hybrid governance mechanisms (Carter and Rogers, 2008).

Hitherto, direct LTSM engagement has not been in the predictive scope of TCE, which traditionally focused on make or buy decisions (Williamson, 2008). Once the buy decision has been made, reliance on market mechanisms would be the LTSM approach of choice. However, not applying LTSM under high PSR leads to high expected opportunity costs such as reputational damage, financial loss and loss of orders. As LTSM is associated with transaction costs in terms of identifying (ex ante) and monitoring and controlling critical lower tier suppliers (ex post), we expect focal firms to choose the approach that effectively reduces expected opportunity costs at the lowest available transaction costs (Williamson, 2008). Transaction costs were coded as the resource intensity of the respective approaches. If a focal firm faces high PSR, resource-intensive LTSM approaches are therefore justified through high expected opportunity costs. In turn, these in-house governance approaches are highly effective in ensuring sustainability conduct among the firm's lower tier suppliers. Hence, the following is proposed:

P7: The higher the focal firm's PSR is, the more likely the firm will choose resource-intensive LTSM approaches.

Figure 1 presents an overview of the final conceptual framework.

---------- Insert Figure 1 approximately here ----------

5. Discussion

Prior research highlighted the importance for focal firms of extending sustainability to their lower tier suppliers (Wilhelm *et al.*, 2016b). However, the literature reports that few buying firms apply genuine LTSM approaches, because these are time-consuming and costly (Grimm *et al.*, 2014). Moreover, a strong resource commitment toward indirect business partners must be considered. Such action is partly in conflict with the traditional recommendations of TCE in order to determine the boundaries of the firm. To provide answers regarding the contextual variables that drive PSR and to delineate TCE within the lower tier supplier context, an abductive, multiple case study approach was applied. This approach allowed us to make predictions concerning the choice of LTSM approaches based on the observed PSR factors and to provide several theoretical and practical contributions.

5.1 Theoretical contributions

This study responds to the plea for more theory-grounded research in SSCM by numerous means (Pagell and Shevchenko, 2014). First, as an established theory in SCM (Delmas and Montiel, 2009; Tate *et al.*, 2011), TCE was applied as a theoretical foundation to frame empirical observations and to explain the findings on choosing among LTSM approaches (Carter and Easton, 2011; Sarkis *et al.*, 2011). While most procurement research applied TCE to direct buyer-supplier relations (Spina *et al.*, 2016), we extended the application of TCE to the buyer-lower tier supplier relationship. Hence, we are extending the application of TCE from dyadic make-or-buy decisions towards mediated relations of lower and distant tier suppliers. With this research, we demonstrate the ability of TCE to predict the relational governance choices to assure compliance with green and social standard of the buying firm at indirect business partners. As a result, the traditional perspective on the boundaries of the firm is challenged as this study identifies the reasons why the firm's boundaries may shift toward cooperative-hybrid or even hierarchical governance mechanisms when enforcing sustainability standards at lower tier suppliers.

In addition, LTSM enables buying firms to differentiate themselves from competitors, win additional orders and/or charge a higher selling price. The risk and the chance

perspectives are integrated in the opportunity-cost-based reasoning. Thus, this study adds to the previous research, which has primarily concentrated on risk-mitigation approaches in the analysis of LTSM (Foerstl *et al.*, 2010; Hofmann *et al.*, 2014). It provides further insights on this topic by discussing different opportunity costs and benefits and balancing them with the transaction costs associated with LTSM.

Finally, this study discusses the effectiveness of different approaches. Regarding the indirect approach, the focal firms admitted that they do not actively control whether their direct suppliers control their own lower tier suppliers, as required in the buying firms' supplier code of conduct. Recent research has shown that, under specific circumstances, buying firms must apply LTSM in such a manner that they subsequently change from compliance- to commitment-based approaches and directly pass on sustainability requirements to lower tier suppliers further upstream (Foerstl *et al.*, 2015). Therefore, the alliance-based LTSM approach is preferred to the compliance-based one since the mutually agreed certifications and auditing standards of common suppliers reduce the transaction costs for both focal firms and lower tier suppliers (Tate *et al.*, 2011).

5.2 Managerial implications

This study provides valuable managerial insights. First, firm executives are advised how to respond to increasing stakeholder pressure regarding environmental and social conduct in their supply networks. Based on the identified approaches, managers can better embrace stakeholder demands and transform them into meaningful and true SSCM projects rather than considering them an additional cost (Gold and Schleper, 2017; Pagell and Shevchenko, 2014).

Specifically, this study provides managers with a practical approach to estimate their firm-specific PSR. This is in line with prior studies which also emphasize the PSR as a main driver and which recommend managers to particularly focus on risk-related indicators in sustainability management contexts (e.g., Busse *et al.*, 2017b; Hajmohammad and Vachon, 2016). Based on the PSR factors, firms obtain a usable and measurable proxy for the expected opportunity costs of not responding to the TCE-grounded drivers. In corporate practice, an exact assessment would require a highly reliable prediction of future outcomes and their financial impact on the buying firm, which is impossible given the bounded rationality of managers. Thus, this approach is more viable and exercisable than a numerical prediction. With our model, we propose consequential actions to be taken by managers that are economically viable given their PSR profile. Referring to Hajmohammad and Vachon (2016, p. 59), a first step to use this knowledge might result in the development of purchasing

procedures and policies "that facilitate supply managers' translation of the information available to them into accurate risk assessments".

Next, practitioners can utilize the suggestion in choosing a set of approaches that match their individual PSR (i.e., opportunity costs) to effectively counter these risks and opportunities at the lowest possible transaction costs. Hence, the model provides managers with a better practically applicable concept than the theoretical ex ante assessment of all future opportunity and transaction costs, which are typically not retrievable in standard cost accounting or management accounting logic. Moreover, the trade-of logic proclaimed by TCE seems more comprehensible to managers than other more abstract theoretical perspectives such as network theory, which would also fit to the research context of LTSM.

6. Conclusions

As most of the environmental and social burden is caused in lower tiers of supply networks, focal buying firms rely on an enriched bouquet of LTSM approaches in order to effectively tackle their sustainability iceberg. This study provides eight approaches to sustainable LTSM grouped into three categories: direct–in-house (holistic, product-, region-, and event-specific), indirect– hybrid (multiplier-, alliance-, and compliance-based) and neglect–market (tier-1-based) (summarized in Figure 1). Focal firms choose between these different approaches depending on the strength of observed contextual factors which are stakeholder salience, structural supply network complexity, product and industry salience, past supply base incidents, socio-economic and cultural distance and lower tier supplier dependency, leading to perceived sustainability risk (PSR).

To elaborate theory of LTSM, an abductive multiple case study approach was applied. Although this method facilitated high internal validity and triangulation, it has inherent limitations, such as low external validity. Therefore, future research should test and refine the propositions using a large-scale survey to validate the generalizability of the results and possibly incorporate additional aspects. Such research could also geographically expand the knowledge and study how buying firms from other developed and, in particular, emerging economies determine their LTSM approaches. Further studies should use a longitudinal study to verify the observations, since PSR profiles develop over time as contextual variables change. Additionally, future research should study LTSM at the purchasing category level to compare and contrast PSR risk profiles for different purchasing tasks. With the transaction as the unit of analysis, one is able to delineate which LTSM approaches are effective responses to a specific contextual PSR factor. In this pursuit, further studies should also extend beyond the focal buying firm as the prime observational unit of analysis and study the perspective of

direct suppliers and the lower tier suppliers on LTSM (Wilhelm, 2011). With regard to our sampling approach, the variety in our cases could pose a limitation as it might obscure a more nuanced and deep-level exploration of LTSM approaches and contextual factors due to the limited comparability across industries.

Finally, in contrast to what TCE proposes, a contractual relation between the focal firm and its lower tier supplier is not necessarily a given in the sample. Therefore, TCE's initial application is surpassed in this study. However, the underlying hypothesis of applying TCE in the research context is that, given certain configurations, focal firms are inclined to apply LTSM. Otherwise, the firms would potentially suffer from opportunity costs linked to reputational damage, loss of orders, or foregone revenues compared with competitors that offer truly sustainable commodities while they do not. Clearly, devoting resources to LTSM is associated with transaction costs in terms of identifying (ex ante) and monitoring (ex post) critical lower tier suppliers. Thus, TCE logic enables one to theorize the opportunities and risk reduction potential of specific LTSM approaches in conjunction with the costs of implementing them, thereby generating relevant and managerially applicable insights. However, there might be other interesting and fruitful theoretical lenses (e.g., institutional theory or network theory) through which LTSM phenomena could be analyzed.

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Firm	FTEs	Revenues	Main products	Informant job title		Public documents	Internal documents	LTSM approach
Chem1	> 110,000	> € 70 Bio.	Standard and fine chemicals, plastics, oil and gas	Ch_{1A} Ch_{1B} Ch_{1C} Ch_{1D} Ch_{1E} Ch_{1F} Ch_{1G} Ch_{1H} Ch_{1I}	Director Global Sourcing Manager Purchasing Category 1 Head Sustainable Procurement Manager Sustainable Procurement Specialist Sustainable Procurement Specialist REACH Head Product Safety Manager Purchasing Category 2 Head Business Development	SR, SCoC	SSA, AG	- Directly evaluate, select and develop indirect suppliers dependent on its region and the purchased product - Indirectly evaluate, select and develop indirect suppliers based on projects, the membership in sustainability alliances, stakeholder information and regulative instruments
Chem2	> 20,000	> € 6 Bio.	Standard and fine chemicals, plastics, oil and gas	Ch_{2A} Ch_{2B} Ch_{2C} Ch_{2D} Ch_{2E} Ch_{2F}	Chief Procurement Officer Head Procurement Strategy Head Global Compliance Head REACH Procurement Manager Procurement Indirect Spent Head Process Management	SR, SCoC	SSA	- Indirectly evaluate, select and develop indirect suppliers based on regulative instruments
Pharma1	> 130,000	> € 40 Bio.	Patented and non-patented medicaments	Ph_{1A} Ph_{1B} Ph_{1C} Ph_{1D} Ph_{1E}	Head Global Sourcing Project Adviser Sustainable Sourcing Head Responsible Procurement Division Manager Responsible Procurement Head Third Party Operations Active Pharmaceutical Ingredients	SR, SCoC	SSA, AG	- Directly evaluate, select and develop indirect suppliers dependent on its region and the purchased product - Indirectly evaluate, select and develop indirect suppliers based on projects, the membership in sustainability alliances, stakeholder information and regulative instruments
Pharma2	> 35,000	> € 10 Bio.	Patented and non-patented medicaments	Ph_{2A} Ph_{2B} Ph_{2C} Ph_{2D} Ph_{2E}	Manager Sustainable Procurement Manager Corporate Purchasing Associate Director Group Procurement Director CSR Director Occupational Safety	SR, SCoC	SSA	- Indirectly evaluate, select and develop indirect suppliers based on stakeholder information and regulative instruments
Furn1	> 1,000	> € 150 Mio.	Office furniture	Fu_{1A} Fu_{1B} Fu_{1C} Fu_{1D}	Chief Executive Officer Head Strategic Sourcing Head Environmental Management Project Manager Ergonomics	Sustain-ability brochure	SSA, AG	- Directly evaluate, select and develop indirect suppliers dependent on the purchased product - Indirectly evaluate, select and develop indirect suppliers based on stakeholder

								information and regulative instrument
Furn2	> 1,500	> € 400 Mio.	Kitchen furniture	Fu_{2A} Fu_{2B} Fu_{2C} Fu_{2D} Fu_{2E}	Regional Senior Buyer Corporate Senior Buyer Plastics Corporate Senior Buyer Timber Head Environmental Management Head Occupational Health and Safety	None	AG	- Directly and indirectly evaluate, select and develop only direct suppliers
Appa1	> 10,000	> € 3 Bio.	Sports- and fashion-wear	Ap_{1A} Ap_{1B} Ap_{1C} Ap_{1D} Ap_{1E}	Chief Sourcing Officer Head Project Management Sourcing Global Director Social Accountability and Environmental Standards Strategic Compliance Officer Specialist Project Management Sourcing	SR, SCoC	SSA, AG	- Directly evaluate, select and develop all indirect suppliers - Indirectly evaluate, select and develop indirect suppliers based on the membership in sustainability alliances and regulative instruments
Appa2	> 1,500	> € 400 Mio.	Lifestyle- and fashion-wear	Ap_{2A} Ap_{2B} Ap_{2C} Ap_{2D}	Strategic Sustainability Coordinator Head Strategic Sustainability Specialist Sustainability Strategy Specialist Corporate Sustainability	SR	None	- Indirectly evaluate, select and develop indirect suppliers based on the membership in sustainability alliances and regulative instruments
Pack1	> 20,000	> € 8 Bio.	Food packaging, cardboard boxes	Pa_{1A} Pa_{1B}	Technical Marketing Manager Europe Procurement Category Manager	SR, SCoC	Purchasing guideline	- Indirectly evaluate, select and develop indirect suppliers based on the membership in sustainability alliances
Pack2	> 10,000	~ € 3 Bio.	Steel and plastic containers	Pa_{2A} Pa_{2B}	Manager Sales and Marketing Supply Chain Manager	SR, SCoC	None	- Indirectly evaluate, select and develop indirect suppliers based on regulative instruments
Semi1	> 30,000	> € 4 Bio.	Semi-conductors, process control devices	Se_{1A} Se_{1B} Se_{1C} Se_{1D}	Supply Chain Director Sales/Marketing Director Purchasing Director Sustainability Director	SR, SCoC	SSA, supplier scorecard	- Indirectly evaluate, select and develop indirect suppliers based on the membership in sustainability alliances and regulative instruments
Semi2	> 30,000	~ € 9 Bio.	Semi-conductors, microprocessors	Se_{2A} Se_{2B}	Chief Purchasing Officer Head of Sales and Operations Europe	SR, SCoC	Purchasing handbook	- Indirectly evaluate, select and develop indirect suppliers based on the membership in sustainability alliances and regulative instruments

Notes: AG = Audit guideline; SCoC = Supplier Code of Conduct; SR = Sustainability report; SSA = Supplier self-assessment

Table 1: Case firm and interviewee demographics

	LTSM approach (definition)	**Representative quotation**
Direct	*Holistic* (all lower tiers)	"We assessed the environmental and social performance of all our direct and indirect suppliers once up to tier-n, which is tier four in our case. We evaluate and develop our tier-2 and tier-3 suppliers on a regular basis and even indicate to our direct and tier-1 suppliers where to source from." *Appa1,* Chief Sourcing Officer
	Product-specific (lower tiers dependent on the product that the respective supplier delivers)	"Normally we just control our tier-1 suppliers, but regarding critical products such as palm-oil, we control up to tier-n." *Chem1,* Head Sustainable Procurement. "Normally we just control suppliers from which we directly source. Regarding certain products such as steel, we assess one tier further up, as we are concerned about waste water and toxic coatings." *Furn1,* Head Environmental Management
	Region-specific (lower tiers dependent on the region that the respective supplier is from)	"It is difficult to audit indirect suppliers, as we do not have a business relation with them. However, in specific regions such as Asia, we audit certain tier-2 suppliers when we suspect non-compliance to labor standards." *Pharma1,* Head Responsible Procurement
	Event-specific (lower tiers if non-compliance is suspected or detected)	"We were informed by an NGO that children collect raw material in fields at an Indian sub-supplier. We had to implement ongoing supplier development programs and modify our supply chain to solve this problem." *Pharma2,* Associate Director Group Procurement
Indirect	*Multiplier-based* (certain direct suppliers by enabling them to evaluate, select and develop their own suppliers)	"We form a team with three suppliers, with the aim of promoting CSR and giving guidance in the form of best practices and customized solutions along our supply chain. The three partners then each introduce the same concept to three additional business partners in their own supply chain." *Chem1,* Sustainability Report
	Alliance-based (evaluate, select and develop lower tiers based on membership in industry & sustainability alliances)	"The majority of our suppliers are certified according to independent standards such as FSC. Monitoring is executed by external auditors who ensure compliance with the certification criteria down to the raw-material level of our supply chain." *Pack1,* Procurement Category Manager
	Compliance-based (obligate all direct suppliers via regulative instruments to evaluate, select and develop their own suppliers)	"We require our suppliers and, in turn, their suppliers to comply with the terms and regulations signed in this document." *Chem2,* Supplier Code of Conduct. "Suppliers shall exercise the source and chain of custody of the minerals tantalum, tin, tungsten and gold and make their due diligence measures available to customers upon customer request." *Semi2,* Supplier Code of Conduct
Neglect	*Tier-1-based* (only first-tier suppliers, no obligation to evaluate, select and develop lower tiers)	"We evaluate and select just our direct suppliers for sustainable criteria." *Furn2,* Corporate Senior Buyer Timber

Table 2: Critical themes to manage lower tier supply networks

TCE dimension	Contextual factor	Representative quotation
Environmental uncertainty	Stakeholder salience	"Our customers from the consumer electronics industry push us to implement sustainable procurement practices even with our sub-suppliers." *Semi1*, Sustainability Director "To respond to a major customer's request for tenders, we needed to provide environmental information on certain materials up to tier-3." *Furn1*, Chief Executive Officer
	Structural supply network complexity	"We have a verification problem in our supply network if we want to evaluate beyond first-tier suppliers that requires effort to generate transparency of second-tier suppliers and beyond." *Semi1*, Sustainability Director
	Product and industry salience	"We must have a clear view of what is going on at the second- and third-tier suppliers and that is why we seek to increase transparency through sub-supplier audits." *Semi1*, Purchasing Director
Behavioral uncertainty	Past incidents in the focal firm's/competitors' supply network	"We were informed by an NGO that children were collecting raw material in fields at an Indian sub-supplier." *Pharma2*, Director CSR "We re-designed our supply chain in the 1990's in South East Asia in order not to face the same trouble that [one of their main competitors] had." *Appa1*, Chief Sourcing Officer
	Socio economic and cultural distance	"Major challenges for us are the cultural and regulatory differences between western European countries and emerging markets, such as China." *Appa2*, Strategic Sustainability Coordinator "It is absolutely essential that we meet our suppliers and their sub-supplier in the region; otherwise their commitment towards us is low." *Appa2*, Specialist Sustainability Strategy
Asset specificity	Lower tier supplier dependency	"Dropping or shifting suppliers is not an option in many cases [in the case of specialty raw materials and chemicals] due to the high market concentration." *Pharma2*, Associate Director Group Procurement "Due to the comparative economic advantages of our supply network in South East Asia it does not make sense to bring back our operations to Germany." *Appa1*, Chief Sourcing Officer

Table 3: Contextual factors leading to perceived sustainability risk

	Contextual factor[a]	Chem1	Chem2	Pharma1	Pharma2	Furn1	Furn2	Appa1	Appa2	Pack1	Pack2	Semi1	Semi2
Environmental uncertainty	Stakeholder salience[b]	high	high	high	high	medium	medium	high	high	high	low	medium	medium
	Structural supply network complexity[c]	high	high	high	high	low	low	high	high	medium	low	medium	high
	Product and industry salience	medium	low	high	high	high	high	high	high	medium	medium	low	low
	Aggregate	**high**	**medium**	**high**	**high**	**medium**	**medium**	**high**	**high**	**medium**	**low**	**medium**	**medium**
Behavioral uncertainty	Past incidents in the supply network[d]	medium	low	high	medium	medium	low	high	medium	low	low	high	medium
	Socio-economic and cultural distance[e]	high	medium	high	medium	low	low	high	high	medium	low	high	high
	Aggregate	**high**	**medium**	**high**	**medium**	**medium**	**low**	**high**	**high**	**medium**	**low**	**high**	**high**
Asset specificity	Lower tier supplier dependency[f]	medium	medium	high	medium	medium	low	low	low	medium	low	medium	medium
	Aggregate PSR	**high**	**medium**	**high**	**medium**	**medium**	**low**	**high**	**medium**	**medium**	**low**	**medium**	**medium**

Notes: a: Each of these constructs is measured on a three-point scale (high, medium and low); b: The underlying factors of stakeholder salience are measured based on the firm's main stakeholder that pushes it to implement sustainability practices. For *Chem1*, *Chem2* and *Semi1*, the firms' shareholders are their main stakeholders. *Pharma1* and *Appa1* indicated NGOs to be their main stakeholders. *Pharma2*, *Pack1*, *Pack2* and *Appa2* are mainly driven by their customers, whereas the government has the largest influence for *Furn2* and *Semi2*; c: Based on vertical, horizontal and spatial complexity (Choi and Hong, 2002); d: Based on the quantity of supplier sustainability incidents over the last seven years; e: Based on the aggregated Hofstede (1980) scales (all six dimensions) for the most important supplier region; f: Total number of critical lower tier supplier.

Table 4: Strength of contextual factors throughout the cases

	LTSM approach[a]	Chem1	Chem2	Pharma1	Pharma2	Furn1	Furn2	Appa1	Appa2	Pack1	Pack2	Semi1	Semi2
Direct	*Holistic*	medium	low	medium	low	low	low	high	low	medium	low	medium	medium
	Product-specific	medium	low	medium	low	medium	low	high	low	medium	medium	medium	low
	Region-specific	medium	low	medium	low	low	low	high	low	low	low	high	medium
	Event-specific	high	high	high	high	high	low	high	high	medium	low	medium	medium
Indirect	*Multiplier-based*	high	medium	high	medium	medium	low	high	low	low	low	medium	low
	Alliance-based	high	high	high	high	medium	low	high	high	medium	low	high	high
	Compliance-based	high	high	high	high	high	low	high	high	high	medium	high	high
Neglect	*Tier-1-based*	low	low	low	Low	low	high	low	low	low	high	low	low

Notes: a: Each of these constructs is measured on a three-point scale (high, medium, low) based on the intensity with which it is pursued.

Table 5: Overview of LTSM approaches across cases

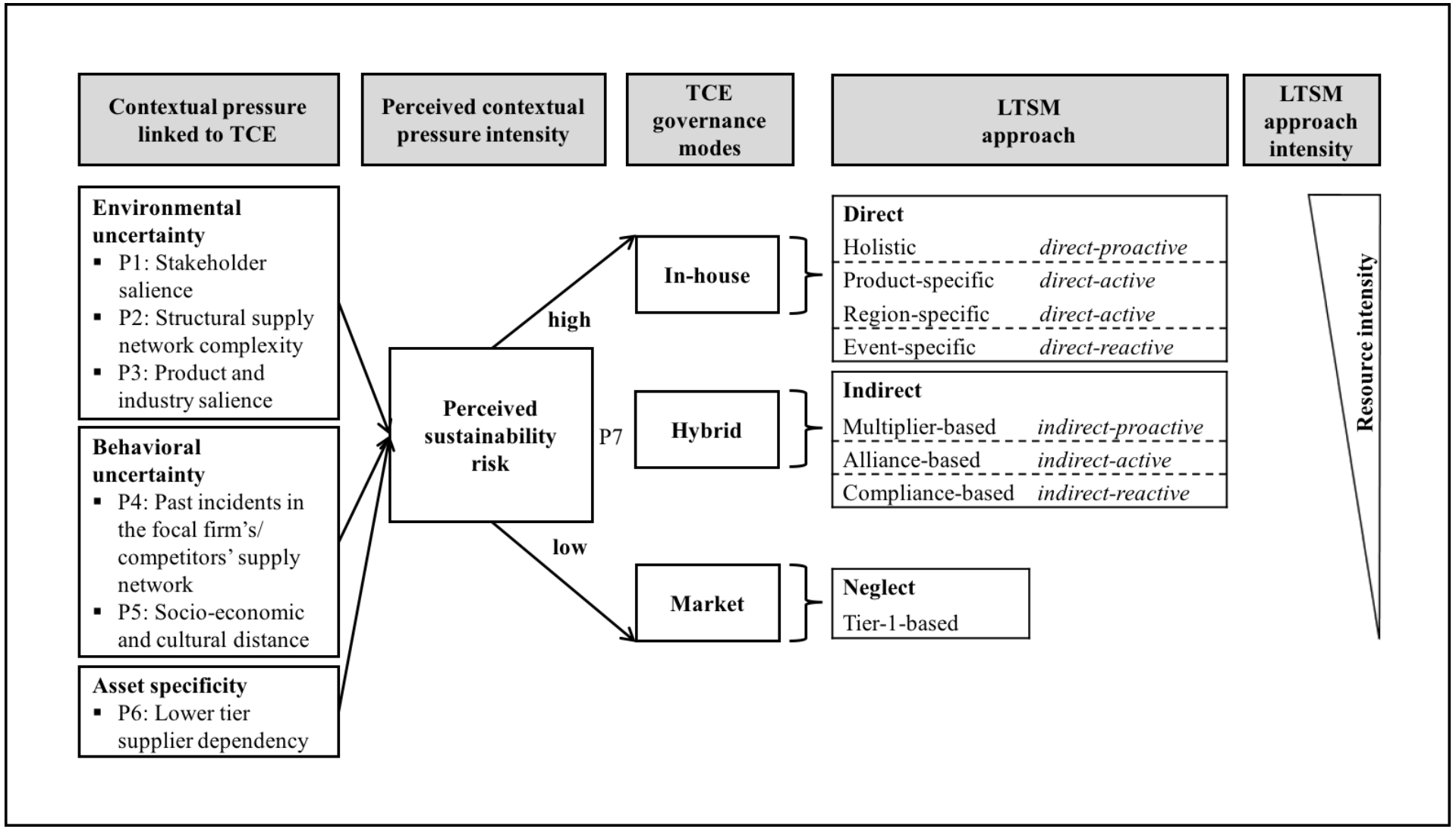

Figure 1: Concluding research framework and propositions